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vCJD in France :
Epidemiology, modeling and predictions

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Epidemiology of CJD in France 1992-1999

- Annual incidence rate of CJD increased from 0.7 to 1.4 per million between 1992 and 1999.
- Postmortem examination was performed in 65% of CJD cases.
- Examination of the prion protein gene available in 70% of CJD cases.
- 4% (20/486) of sporadic CJD cases (definite and probable) were under the age of 50 years.

vCJD : Case 1

Date of birth : 1968

Male

Date of disease onset : January 1995

Date of death : January 1996

Profession : mechanic

No travel in UK

"Tonic" for body building (oral use)

Medical history : congenital glaucoma (surgery at age 6 months)

PRNP Codon 129 : methionine-methionine

vCJD : Case 2

Date of birth : 1963

Female

Date of disease onset : December 1998

Date of death : February 2000

Profession : book-keeper

No travel in UK

PRNP codon 129 : methionine-methionine

vCJD epidemic in France : modeling and predictions

Parameters

- Predicted number of vCJD cases in UK.
- Level of exposure of the French population to the Bovine Spongiform Encephalopathy (BSE) agent.
- United Kingdom : France exposure ratio.

Exposure of the French population to the Bovine Spongiform Encephalopathy agent

Potential sources

- BSE cases in France
- Travels in Switzerland and Portugal
- Travels in United Kingdom/Republic of Ireland
- Contaminated bovine materials imported from United Kingdom

The French Blood Donor Travel Survey

Conducted by the Agence Française de Sécurité Sanitaire des Produits de Santé (AFSSa PS)

- 10 blood transfusion centers located throughout France.
- One-week survey (October 18-24, 1999) including all persons who came to the selected centers to donate blood (N=17596)
- Questionnaire similar to that used in the US 1999 Blood Donor Travel Survey

The French Blood Donor Travel Survey

Distribution by age and sex of the survey population and the French general population

	Men (%)		Women (%)	
Age (yrs)	Survey	General	Survey	General
18-29	26.1	26.8	39.6	26.0
30-39	22.2	23.8	20.4	23.7
40-49	28.6	23.1	23.2	23.3
50-65	23.2	26.2	16.8	27.0

Prevalence of Donor travel/residence in United-Kingdom/Republic of Ireland 1980-1996

- 1980-89 20.5%

  1990-96 25.2%

  1980-96 34.6% (22.6% in US donors)

- Prevalence of travel/residence was lower in older donors compared to 18-29 years old donors

- No gender difference

- Significant differences between centers

Cumulative prevalence of Donor Travel to UK/Republic of Ireland for 1980-1996.

Comparison between USA and France

	Prevalence (%)	
Duration	USA	France
≥ 1 day	22.6	34.6
≥ 1 month	4.9	5.6
≥ 5 months	2.0	1.9
≥ 9 months	1.3	1.0
≥ 1 year	1.2	0.7
≥ 3 years	0.7	0.4
≥ 5 years	0.4	0.1

The French Blood Donor Survey : Main results

- About one-third of the blood donor population reported travel/residence in UK/Rep. of Ireland 1980-1996
- Short stays, i.e. less than 2 weeks between 1980 and 1996, accounted for about 10% of the total person-days of travel/residence in United Kingdom
- Assuming that the Blood Donor Survey provided a rough estimate of the travel/residence in UK of the French population aged 18-65 years, these travels accounted for 3/1000 of the total person-days. Residence in France accounted for 997/1000 of the total person-days

Prediction of the vCJD epidemic in France

Main assumption : the risk (or incidence) ratio between United-Kingdom and France is proportional to the BSE exposure ratio between UK and France

This main assumption implies that the basic assumptions described in the February 2000 AFSSaPS report (attachment 7) are true.

Hypothesis 2

The risk of exposure to BSE linked to consumption of British bovine products in the United Kingdom and the risk linked to the consumption of British bovine products in France are considered equivalent. This hypthesis does not take into account possible differences in the nature of British bovine products, especially some types of offal, entering the food chains in the United Kingdom and France, or those possibly resulting from differences in modes of slaughter and meat preparation in the two countries, or differences in the age distribution of the animals consumed.

Hypothesis 6

The ratio of exposure in France and the United Kingdom was constant throughout the period considered. This hypothesis and the previous hypotheses imply that the ratio of the risks of infection by the BSE agent for a given duration of exposure was also constant during the period considered.

Assessment of the exposure to the French population to the BSE agent

Parameters

N : Total number of days 1980-1996

n_i : Number of days spent in UK by person i

P_F : Total French population aged 18-65 years

p : Proportion of French people who travelled in UK between 1980 and 1996

E_F : Level of exposure to the BSE agent for one day in France

E_{UK} : Exposure to the BSE agent for one day in UK

Assessment of the exposure to the French population to the BSE agent

No travel in UK : $$P_F.(1-p).N.E_F \qquad (1)$$

Travel in UK : $$\sum_{i=1}^{P_F.p}(N-n_i)E_F + n_iE_{UK} \qquad (2)$$

$$(1)+(2) = P_F.N.E_F + (E_{UK}-E_F)\sum_{i=1}^{P_F.p} n_i$$

Prediction of the vCJD epidemic in France

Main assumption

$vCJD_F$= number of vCJD in France

$vCJD_{UK}$= number of vCJD in UK

$$vCJD_F = vCJD_{UK} \cdot \left[\frac{P_F.N.E_F + (E_{UK} - E_F) \sum_{i=1}^{P_F.p} n_i}{P_{UK}.N.E_{UK}} \right]$$

$$vCJD_F = vCJD_{UK} \cdot \left[\frac{E_F}{E_{UK}} + \frac{(E_{UK} - E_F) \sum_{i=1}^{P_F.p} n_i}{P_{UK}.N.E_{UK}} \right]$$

Prediction of the vCJD epidemic in France

Main parameter : $\frac{E_F}{E_{UK}} = ?$

Available data to estimate E_F, E_{UK}

- ***France.*** *Data from :*
  - Office national interprofessionnel des viandes, de l 'élevage et de l'aviculture (OFIVAL)
  - Direction générale des douanes et des droits indirects (DGDDI), Ministère de l 'Economie et des Finances
- ***United Kingdom.*** *Data from :*
  - HM Customs and Excise

These data suggest that the ratio $\frac{E_F}{E_{UK}}$ is equal to $[0.05 - 0.10]$

Conclusion

Despite limitations about accuracy of underlying assumptions, reliability of data about French importations of bovine materials from United Kingdom between 1980 and 1996, and reliability of data about travel/residence in United Kingdom, this study provides a rough estimate of the vCJD risk ratio between France and United Kingdom.